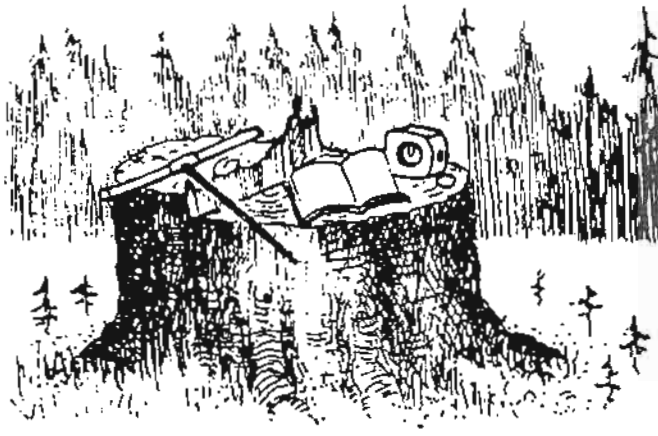


JDSF Newsletter

Jackson Demonstration State Forest

State of California Dept. of Forestry P.O. Box 1185 Fort Bragg, CA. 95437

No. 47 Spring 1993

SIMULATION OF A LONG TERM MANAGEMENT PLAN DEVELOPMENT PROCESS UNDER THE PROPOSED SUSTAINED YIELD FORESTRY ACT OF 1992/[1]

A HUMBOLDT STATE UNIVERSITY FORESTRY CAPSTONE CLASS PROJECT

During the past year, attempts were made to significantly change the forest practice rules through the legislature. A bill entitled the Sustainable Forestry Reform Act of 1992 was developed and lobbied for by a coalition of various interest groups and state legislators. At the time, little or no detailed analyses of the potential planning and implentation problems were done or available. This article summarizes the report which was produced as a result of this project.

Capstone Class Proposal

The opportunity to explore the ramifications of this legislative reform of the forest rules became possible when Humboldt State University professor Richard Barber expressed interest in developing a simulation using Jackson Demonstration State Forest (JDSF) data. Using inventory and geographic information system (GIS) data available here, Dr. Barber wanted to develop a simulated Long Term Timber Management Plan (LTTMP) for JDSF as a class excercise for their Forestry Capstone class. The class, co-directed by Dr. Steve Carlson, had 12 forestry students and 6 natural resource planning students who did all the GIS work for the project. JDSF staff foresters John Griffen and Hugh Scanlon spent several hundred hours obtaining necessary information and providing feedback for the project. Dr. Barber felt that the state forest had the necessary diverse stand structure to allow a realistic analysis of providing for certain amounts of various vegetation classes (e.g., late seral stage). The project would also relate current real world data and planning problems to existing forest plan modeling technology. Dr. Barber also noted that none of the LTTMP specific requirements had been tested regarding the combined and interaction effects of the individual requirements. The class project's goal was to develop the processes for such a plan, identifying and documenting the problems encountered, creating alternative strategies and identifying requirements that could not be met. An important component was testing the feasibility of achieving the required growth and yield quantities as specified by the legislation.

LTTMP Requirement

A key element of this legislation was the requirement for developing a LTTMP for type A (20,000+acres) or B timberlands (5,000-20,000 acres) owned or controlled by one person. This was supposed to provide regulatory agencies with the plan of how the timberland owner or controller would achieve and maintain maximum sustained production (MSP) while providing for and maintaining forest structure diversity over the next 100 years. Accomplishing this task effectively would require developing and maintaining an estimate of inventory, growth, yield and area for each stand age and structure, seral stage class and providing a harvest schedule per decade during this time period. The plan would have to be updated and approved by the Department every decade. Analytical methodologies and computer projection

1/ Norm Henry, Forester II, Demonstrations & Experiments Program, Jackson Demonstration State Forest

techniques could be subject to departmental review and audit.

Inventory Status - JDSF

The current JDSF stand inventory database has resulted from several years of sequenced projects contracted out to various consulting firms. The initial project was a fall and buck study to calibrate the volume equations used in the redwood growth model -Cooperative Redwood Yield Project Timber Output Simulator - (CRYPTOS) to JDSF stands. Using the most recent aerial photography of the forest property, a consulting firm from Utah (Triple A) produced a vegetation type map of the forest. A key phase was the development of a new more intensive forest inventory system (see newsletter No. 28) by the firm of Hammon, Jensen and Wallen. East-West Forestry Associates installed the inventory plots and also input the plot information onto computer data files. Checking the plot information and processing it through the inventory system has been a long and arduous task (see newsletter No. 45). The totals are still considered preliminary until further review is made.

MSP Analysis

Maximum sustained production as defined in the proposed legislation encompasses two elements. The forest landowner would have to achieve the forest site productive potential by attaining some percentage of volume growth predicted at the age of culmination of mean annual increment (CMAI) while protecting forest health and other resource values. Achieving the wood production potential of an ownership involves attaining certain stand diameter (DBH) goals. These two values are either derived from an appropriate natural stand yield table with an upper limit of 100 years if culmination is not reached in the table at that age, or derived from yield tables developed by the Board of Forestry (BOF). The only currently published yield tables for coast redwood are Lindquist and Palley's Bulletin 796. Figure one illustrates the productivity goals at various site classes using Bulletin. 796. The Cooperative Redwood

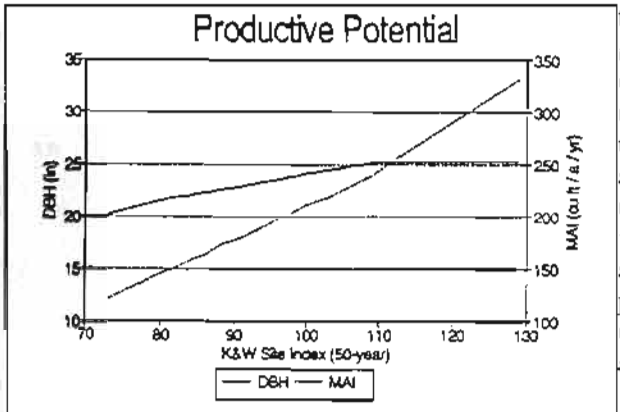


Figure 1 Natural Stand Standards for DBH and MAI

Yield Project's growth model (CRYPTOS) developed by Krumland and Wensel (KW) at UC Berkeley is used in this analysis as the growth model for managed stands. Bul. 796 is used as the model or standard for natural stands in this analysis. This analysis emphasizes the fact Bul. 796 and CRYPTOS have significant shortcomings in their applicability for predicting uneven-aged stand development. For example, the hardwood component implicitly expressed in existing yield tables (2.7% in Bul. 796) probably do not represent the amount to be retained under the new regulations nor encountered in many of the current stands, particularly on poor to moderate sites. CRYPTOS may underestimate thinning response and mortality in redwood stands managed for uneven-aged structure. This has serious implications in implementing the legislation as it is a presumptive fact that such knowledge and models needed for uneven-aged and late seral stage management exists which currently are not developed. Therefore any modeling and predictions made must be viewed as speculative for the long term. The need for additional research in these areas is urgent The study found that to reach both CMAI and DBH goals using even-aged management, methodology generally recognized as "New Forestry" had to be used. This term refers to various planning and silvicultural strategies that emphasize biodiversity by retaining some percentage of live trees, snags and other large woody debris for post harvest habitat. Other objectives are creating more variation in harvest unit size, rotation length and spatial orientation to minimize landscape fragmentation. Jerry Franklin, Chief Plant Ecologist for the USFS has been one of the principal developers and advocate for implementing these principles in current forest management. In this application Dr. Barber used principles of green tree retention in an even-aged management scheme to simulate "new forestry" prescriptions. This was compared to an "old forestry" prescription which had no retention. Using the "new forestry" prescription, one scenario uses 26 0.66 acre harvest units configured as a 20 acre cleared core area and a 300 foot radius of leave stand simulating a 25 percent green tree retention. The new stand is grown to an average size of 10 inches DBH (approximate age 50) at which time a commercial "low thinning" is done which mechanically increases the residual stand DBH about 20 percent. This equates to harvesting about 10mbf/ac. and leaving 35-40mbf/ac. The residual stand is then grown to age 200 and using iterative procedures, selection of the best combination of rotation age and percentage "new forestry" leave is made to meet the requirements of Bul. 796 CMAI and DBH. Running simulations using the CRYPTOS growth model under both prescriptions indicated the "new forestry" prescription with the 25 percent green tree retention was the only method meeting Bul. 796 values at 100 years for all site classes. It became increasingly difficult to meet the standards as the site improved and generally increased thinning to increase DBH resulted in decreased MAI. Using an "old forestry" prescription, increasing rotation age increased both MAI and DBH but not to Bul 796 standards on site classes above site IV. Project and class deadlines did not permit all possible simulations to be run so some other unexplored method might also give reasonable results.

Even-Aged Mgt.

The legislation called for a minimum of 10 percent of the forest area to be occupied by the oldest age class by decade meeting

diameter requirements of those stands reported in the natural yield table (Bul. 796) at CMAI. A similar silvicultural approach was used in evaluating this regulation. Fifteen 25 year old plantation stand samples were used as the basis for growing stands at various site indices. Although 12 of the 15 plots had actual site indices (SI) of 85 (KW), which uses a 50 year base age, the assumption was that these sites would properly reflect sites with higher SI when modeled through CRYPTOS at SI of 110, 95 and 85. The averages of nine of the fifteen plots met the requirements which equate to meeting a goal of 190 ft^2 basal area and 200 trees/ac. at age 25. The impacts of thinning and site on CMAI and DBHrelationships in this analysis were similar to the MSP analysis.

Uneven-aged Management

Ten percent of the stand basal area has to be in the oldest age class by decade using this type of management under the legislation. Two objectives were sought in this phase of the analysis. The first objective was to produce a sustainable forest using 20 year cutting cycles, maintaining or enhancing stand structure and diameter diversity. Second, to provide a method for converting even-aged stand types into uneven-aged using CRYPTOS which is a single tree, distance independent even-aged stand simulator. Actual stand ingrowth information was taken from the Caspar Cutting Trials (CCT) (Lindquist 1984) and a redwood sprout study (Barrette 1988). The simulation stand data, judged representative of those stands in the uneven-aged units, contained 81 percent redwood and 16 percent Douglas-fir. This high percentage of redwood also ensured adequate redwood sprout regeneration. The initial simulation process involved harvesting the trees, introducing net ingrowth, growing for a set period and repeating the cycle. Unfortunately, CRYPTOS is not designed to be interactive once processing is begun. This required exiting each time to add a spreadsheet computed ingrowth file that greatly lengthened run times. A prototype interactive uneven-aged cutting sub-routine developed by Dr. Jan Derksen was only acquired late in the analysis but made the task of doing the many iterations of combinations of 3 site classes and 3 stocking levels possible. The analysis indicated that the uneven-aged management techniques came close to meeting the MSP requirements and although not explicitly calculated, meeting the 10 percent basal area could be done. However, the results also show that mostly small diameter trees (6"-10"DBH) are harvested, significantly lowering the log quality harvested from these stands. With respect to all of the results in this analysis, current models and techniques available to simulate various uneven-aged management schemes are seriously inadequate to have real confidence in the results.

Table 1. Land Use Classification for JDSF

Total Legal Description Acres	50,200	Percent
found acres not in GIS[1]	-80	
remaining difference[1]	-1238	
Total GIS acres	48,882	100.0
Conservation Camps	417	0.85
Non-timber types[2]	984	2.01
Roads and Power lines	1,480	3.03
Timberland Acres	46,061	94.23
Old Growth Reserves (late seral)	709	1.45
WLPZ Unavailable (late seral)	182	0.37
WLPZ Available (late seral)	6258	12.80
Inaccessible (late seral)	442	0.90
Camp Ground Buffers (late seral)	163	0.33
(total Late Seral)	(7,754)	15.86
Inaccessible (not late seral)	164	0.34
CG Buffers (not late seral)	61	0.12
Sliver noise	6	0.01
General Forest	38,016	77.77
General Even-aged	26,307	53.82
Total Uneven-aged	11,708	23.96
General Uneven-aged	10,109	20.68
NIMBY Buffers	701	1.43
Public Road Buffers	817	1.67

Late Seral Stage

Section 4596 of the proposed act requires that 15 percent of the commercial forest land within an ownership will meet late seral stage requirements. Ancient (previously non-harvested) or old-growth stands are counted first and if not available, stands within the watercourse protection zone (WLPZ) of class I and II watercourses are used. Since there is little remaining old-growth on JDSF most of the recruitment had to come from the WlPZ stands. The simulation run showed the recruitment and continued maintenance of the required 6 trees/ac. over 40 inches could be done if in conjunction with other types of management. Harvesting and maintaining an isolated late seral stand may be unfeasible considering the damage that would be done to a necessarily multi-tiered stand when harvesting extremely large trees unless adjacent cleared areas were available to fell into. Again, the results reached are based on a number of questionable assumptions and extrapolations. The primary concern is the confidence in using similar ingrowth files each 20 years under heavy stocking levels (200-250 ft2) when it is expected that the success of regeneration and ingowth would be less under heavy canopy. Another concern is growing stands to 500 years plus which push CRYPTOS way beyond its design limit. It is, however, the only tool available to achieve the objectives of this analysis.

Harvest Scheduling

Dr. Barber has developed a harvest schedule program using binary search techniques called EASYPLAN that currently can model harvest flow under even or uneven-aged or a combination using area, volume or even-flow control. Harvest scheduling provides most of the capability to comply with sustainability reporting requirements like documenting maximum sustained production and other stand parameters over the 100 year planning period. The initial expectation was that the harvest scheduling would be a major part of the study. However, 15 weeks were needed to process the data for input and just one day was needed to run it. Traditionally, harvest scheduling has been used to determine rotation length and/or cutting cycle. The proposed legislation would change the role of harvest schedulers to finding various pathways to a condition predicated by the natural yield table and doing the accounting work nec-

essary to document the composition and distribution of the inventory.

The data processing requirements quickly become massive. If all 50 timber types, even and uneven-aged management units, 4 site classes and 11 planning watersheds on the forest were included at least 4,400 potential activities would have to be tracked. Various parameters had to be reduced to make this project feasible, one of them being to divide the forest property into an east and west compartment. Scheduling for only the eastern half compartment was completed due to time constraints.

Area control (AC), Percent of Inventory (POI), and Percent of Growth (POG), harvest scheduling runs were compared for ability to regulate the uneven-aged inventory on a 20-year cutting cycle and the even-aged inventory on an 80-year rotation under the legislation constraints. Area control was judged to be the superior system on both types. The AC schedule had the highest value and volume harvest while achieving the desired regulation in two decades in the uneven-aged units. In analyzing the even-aged calculations, POI was observed to have the lowest total volume and value and did not achieve adequate regulation. POG had the highest in both categories but was judged not to be well regulated enough to meet expected standards although harvest and growth were balanced at 100 years. Both even and uneven-aged systems exceeded MSP standards by 3 percent although the uneven-aged system fell short 16 % in meeting the CMAI requirements.

GIS

Another necessary tool in effectively implementing the proposed legislation is the use of GIS (Geographic Information System) software used on a sufficiently powerful computer. Addressing late seral and harvest scheduling issues require a precise category of land use. Table one was the result of a lenthy and laborius process in which GIS was indispensable. Over 500 hours were spent on this phase. As this phase of the project developed, computing power became a problem as data layers grew larger and more complex. The most complex layer consisted of over 15,000 polygons which could be as small as 0.5 acre. Initial work involved updating existing data layers such as the original HJW soils layer, timber types to reflect recent harvesting activities, roads and management units and several others. The overlay process to calculate acreage and other statistical information took considerable time to accomplish. A database using pcARC/INFO GIS software was developed which quantified spatial relationships such as acreage and mapping locations of management units, non-timber types, campground buffers, old-growth reserves and conservation camps. The categories included in this database were given a hierarchical rating so that when overlaps occurred, the higher priority variable of interest was used. A number of time consuming problems were dealt with in this phase of the project. One was deciding how to prioritize the various categories in case of overlap problems. Another was determining what areas could be used for late seral stands such as WLPZ available and non-available, inaccessible areas and campground buffers.

Information being the single most important item in preparing a LTTMP, the format and extent of inventory and GIS information is critical to their usability and completeness for efficient processing in the analysis phase. For example the inventory was stratified by species-size and stocking but not by planning watersheds, site class or management unit type. Certain types of management areas (uneven-aged, late seral and young plantations) should have had data on all trees. The current inventory goes down to 7 inches on a 1/20 ac. subplot and to 11 inches on the remainder of the 1/5 ac. main plot. The plots were not geo-referenced, allowing no adjustments when an obvious mismatch between the plot information and the vegetation type was found. These type of polygon adjustments could have been done during the inventory if accurate plot locations were known.

In Conclusion

The world of harvest scheduling and computer simulation one may have gathered is very complex and is probably bewildering to many folks. The reality though is that these types of modeling systems are necessary to implement the requirements of this legislation. As Dr. Barber has noted in his report, "The planning process needed requires computer and analytic modeling skills well beyond those possessed by the average good Forester with a BS degree."

On the systems side, currently the stage of development of simulators, computer hardware and management tools is far from optimal for performing a complete, accurate management plan of the complexity envisioned by the proposed legislation. There are no models for uneven-aged and late seral management existing presently. Attempting to do so is speculative and results should be viewed as tentative as data from further research is obtained.

SEMPERVIRENS

BY BILL BAXTER

We on the North Coast live and work in some of the most productive conifer forests found any where on the planet. I find that to be pretty exciting as it relates to my position as the silviculturalist on the Jackson Demonstration State Forest. "Sempervirens" is going to be a regular column which discusses how silvicultural prescriptions are developed on the State Forest because redwood silvics is so unique among conifer forests.

Some of the topics that may be covered in future issues of "Sempervirens" include specifications for various vegetation manangement treatments, when to pre-commercial thin, promoting late successional habitat, maintaining redwood seedling vigor, using prescribed fire, developing a tree improvement program, evaluating adequate site occupancy, controlling hardwoods, and practicing uneven-aged management. This list could on and on, and I am sure that you can think of additional topics that might be explored.

"Sempervirens" will spell out the JDSF's stand management objectives so that you can evaluate the silvicultural prescription, and determine how it relates to your own land managemnent objectives. The discussion will focus on how various elements of

the forest structure are modified, and what is expected in terms of results. All relevant attributes to the project will be quantified (or estimated) to the best of my ability. Sources or references will be documented, where available or appropriate.

You, the reader of these articles, have an important role to play. There is plenty of room for divergent view points for any given issue. I hope that "Sempervirens" will provide a point of discussion among foresters. You may have also had the opportunity to evaluate the efficacy of various silvicultural treatments, and I would be happy to hear about your results.

"Sempervirens" is not being published to establish the "correct" way of conducting redwood silviculture, nor will it be strictly a scientific document. The main purpose of "Sempervirens" is to have an informed and interesting dialog with individuals who practice forestry on California's North Coast. Hopefully the body of knowledge about the silvics of redwoods will be "forever living", just like the trees themselves. The first article is below.

A CUT SOME, LEAVE SOME PRESCRIPTION FOR THE FUTURE

Even-aged regeneration methods are increasingly unpopular with the general public though the silvicultural merits of these methods are well documented in professional journals. The State Forest staff thought that developing a prototype even-aged silvicultural prescription providing for growth rates observed in even-aged redwood forests yet avoiding the negative aspects associated with conventional regeneration cutting was worth pursuing. This alternative prescription would emphasize maintenance of vertical forest structure (e.g., multiple canopy levels, diverse tree sizes, snags, down woody debris, etc) over the course of the rotation for wildlife habitat and aesthetics.

The following Structure Tree Even-aged Alternative Prescription was prepared for Stand "D" located in the Berry Gulch 1993 Timber Sale. This stand is 19 acres in size, and is proposed for an even-aged regeneration harvest with skyline yarding. Under this prescription, approximately 10 to 15 trees per acre will be retained and allowed to grow approximately double the planned rotation age while establishing a new even-aged stand. These structure trees will be harvested when this newly established stand is regenerated in approximately 80 to 100 years.

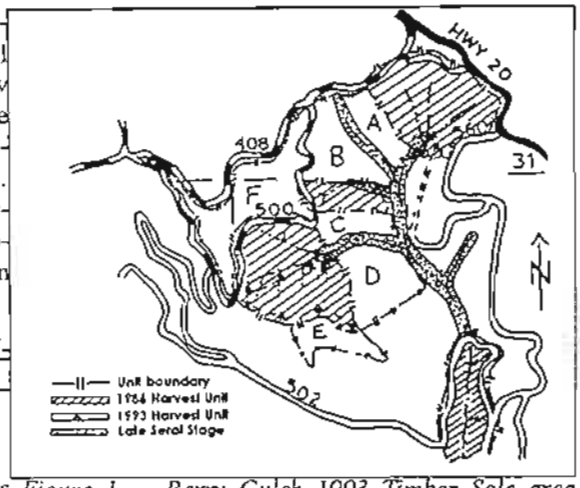


Figure 1. Berry Gulch 1993 Timber Sale area showing unit D - Structure Tree Prescription unit.

STRUCTURE TREE EVEN-AGED ALTERNATIVE PRESCRIPTION:

A. Stand History:

Most of the old growth trees were harvested during the 1920's. This timber stand was tractor logged in the late 1960's to remove the remaining old growth residual trees. Most of the older second growth trees are now 60 to 70 years of age. One can also find small aggregations of 20 to 30 year old trees due to the 1960's timber operations.

B. Overall Silvicultural Objectives:

The following objectives were established before plan development:

1. Even-aged Management

The Berry Gulch area is located in a part of the State Forest where even-aged silvicultural systems are emphasized unless there are compelling reasons to do otherwise.

2. Landscape Forest Habitat Issues

A conventionally regulated even-aged forest will contain few snags, large down woody debris, late successional forest habitat, or functional connectivity for later successional wildlife species, unless these components are specifically planned for. These issues were addressed at the landscape level for this timber sale, and include the following:

A. Forest Fragmentation

Franklin and Forman (1987), discuss how the spatial configuration and size of clearcuts affect the habitat characteristics of the landscape through fragmentation. One of the delaterious effects is the reduction of interior habitat values for various wildlife species with increasing fragmentation. One of the goals established at the onset of this project was to minimize fragmentation as the adjacent stands mature. Stand "D" was selected for treatment in part due to its proximity to the 1986 Berry Gulch regeneration units, and because the existing stand structure was suitable for the proposed alternative prescription.

B. Late Successional Forest Habitat & Connectivity

Functional wildlife habitat includes providing for the needs of wildlife species associated with late successional stages of forest development. The State Forest decided to retain and/or recruit late successional forest corridors on all class I streams, and on the principal class II streams found within the Berry Gulch Timber Sale. Some class III streams were also designated to provide functional connectivity between habitat types.

C. Structural Elements

Traditional forestry has emphasized the need for maintaining a forest stand in a healthy, vigorously growing condition to maximize volume growth. A consequence of this approach has been the reduction of snags and large woody debris in the forest environment. Redwoods in the northwestern California coastal forests have demonstrated low mortality rates over a rotation length of 70 to 100 years. Non-old-growth redwood snags typically last between 5 and 20 years. Leaving only snags within an even-aged unit for structure could result in very little vertical structure for possibly as long as 60 years. One can increase the probability of providing snags and large

woody debris over time if some trees are allowed to grow to twice the desired rotation age. Rotation ages on the State Forest are approximately 80 to 100 years in length.

The question is then of how many trees should be left and how should they be arranged over the landscape. Jackson State Forest sought the assistance of Brad Valentine, CDF Region I Wildlife Biologist, in the development of the Structure Tree Prescription. Mr. Valentine wrote the following in support of this prescription. "Franklin and Spies (1991), Composition, Function, and Structure of Old Growth Douglas-fir Forests, provide some strategy for maintaining old-growth-like habitat during timber operations. Indeed, they suggest that silvicultural treatments could accelerate the development of old-growth structural and compositional features. Of relevance to this prescription, one option discusses partial cutting in which 10 to 40 percent of the living, dominant, mature trees, as well as snags and logs are retained. For the Douglas-fir forest, they suggest 8 to 12 trees per acre be retained."

"Using the lower end of the range as a goal for the more upland areas of the prescription ensures that these features will provide some benefit across the landscape and should enhance on-site habitat values and dispersal opportunities across the unit. Using the upper end of the goals in 2-3 pockets per acre near the WLPZ will enhance the "old growth" characteristics of the WLPZ and should help mimic forest conditions following natural catastrophes; eg., wildfire leaves proportionately more live trees in drainage bottoms and frequently in clumps."

This Structure Tree even-aged Alternative Prescription followed similar criteria established by Franklin and Spies for the Douglas-fir type to have a conceptual starting point in the development of a prescription that provides for structural diversity under an even-aged silvicultural system. Under this prescription we retained 10 to 15 structure trees per acre. We also retained higher densities of structure trees in areas lower on the slope that are in proximity to the WLPZ.

C. Silvicultural Prescriptions

The following discussion describes site specific information and proposed treatments for stand D.

Existing Stand Data

The average Site Index was class II (Site 165, Lindquist and Palley). The site index was determined from the 1987 Soil Conservation Service soil maps and spot checked in the field. The stand age was approximately 70 years

Existing Stocking Levels For Trees Greater Than 11" At Dbh

Species	Trees Per Acre	Total Basal Area
Redwood	26	82
Douglas-fir	43	122
Grand fir	3	13
Tan Oak	10	11
Total	84	228

The tabular values given in the table above were derived from 21 variable radius plots taken on a systematic grid throughout Unit D. The estimated existing conifer volume is 51 MBF/acre.

Silvicultural Criteria:

1. The standard silvicultural regeneration method that is most similar is the Seed Tree Step. This method was not selected because the seed trees are generally harvested once young conifer seedlings are established. The structure trees are planned for harvest at twice the planned rotation age, and will not be removed after the establishment of new conifer regeneration.

The seed tree step uses seed trees as the primary source of seed for the establishment of natural regeneration. This prescription differs with the established use of seed trees because this cut unit will be artificially regenerated following the completion of active operations. Natural regeneration methods should have a proper seed bed established before seed fall, and site preparation measures, such as broadcast burning, could end up killing most of the potential structure trees. Artificial regeneration methods provide for the prompt establishment of seedlings. Artificial methods also provide for the control of species composition and the spacing between planted seedlings. The purpose of the structure trees is to provide wildlife habitat structure. Merchantable structure trees will be harvested at the end of the second rotation period (approximately 80 to 100 years from now).

2. The silvicultural system would be considered a regeneration method under an even-aged silvicultural system. This prescription will meet the Society of American Foresters definition of even-aged because the proposed stand structure will have less than three age classes present at the time of the next final harvest.

3. Broadcast burning is not anticipated because suitable numbers of plantable sites are expected to be available once logging operations are completed. This conclusion is based on reviewing other completed cut units where similar volumes per acre were removed.

The slightly northeast aspect should result in a favorable micro-site condition for seedling establishment. Competitive brush species are not expected to develop quickly. This is based on the fact that this unit is not planned to be burned. The goal is to maintain seedling tree vigor throughout all phases of plantation establishment. The use of ground applied herbicides may be required three years after logging operations are completed to control tanoak (a sprouting hardwood species).

Structure Tree - Even-aged Alternative Prescription:

1. Harvest and remove all merchantable conifers and all hardwoods greater than or equal to 12 inches at dbh, except for designated structure trees and snags (Note: Structure trees are illustrated in Fig. 1).

2. Retain all snags greater than 16 inches at dbh, unless they are a safety hazard.

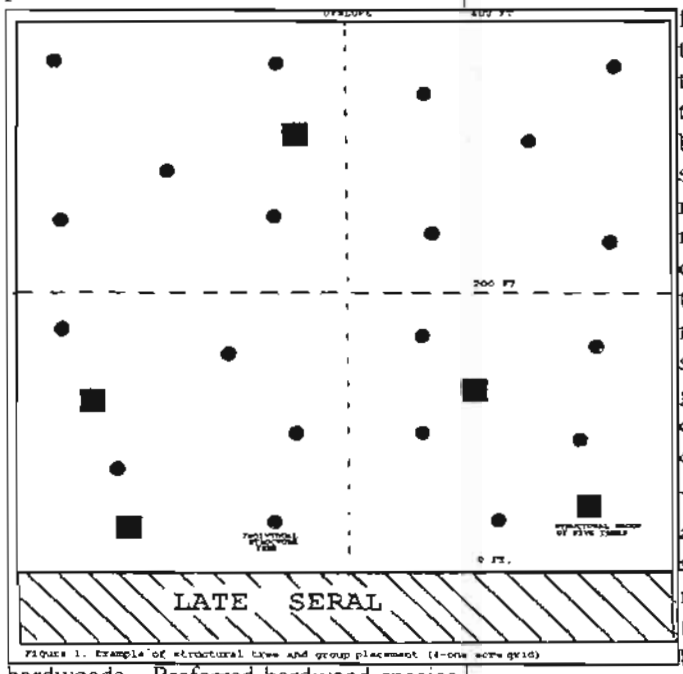
3. Structure trees will be identified and marked for retention as described below.

Within 200 feet of late successional corridors, approximately 15 structure trees/ac. will be left . If greater than 200 feet from

the late successional corridor, 5 to 10 trees/acre will be left .

Conifers should have a dominant or co-dominant crown position. Trees should have crowns that indicate a healthy growing condition (preferably having live crown ratios greater than 30 percent). Approximately 75 percent of the structure trees should be conifers. Preferred conifer species composition is 60 percent Douglas-fir and 40 percent redwood.

Hardwoods should have a tall tree form,and should be greater than or equal to 12 inches at dbh. Approximately 25 percent of the structure trees should be hardwoods. Preferred hardwood species composition by order of listing are madrone, chinquapin, and tanoak.



Individual Structure Trees:

Designate 5 individual structure trees per acre equally spaced from one another (Approximately a 95 foot spacing) over at least 70 percent of the area.

Structure Groups:

Designate 2 structure groups per acre within 200' of the late seral. Designate 1 structure group for approximately each 2 acres beyond the 200' distance from the late seral.

Structure Group Criteria:

Structure groups should consist of 5 structure trees. Attempt to maintain a maximum spacing of 15 to 20 feet between structure trees located within the same group.

Structure Tree Data for Stand "D"

	Redwood	Douglas-fir	Grand Fir	Hardwoods
No. trees	81	82	4	52
Net vol.	47.7MBF	79.4 MBF	3.6 MBF	No Est.

Post Sale Treatments:

Year 0 - Cut all remaining vegetation greater than or equal to one inch DBH at ground level. This treatment should be conducted within 6 weeks of the proposed date for planting. The intent of this treatment is to take maximum advantage of favorable site conditions for seedling establishment. By cutting all woody stems before planting, the seedlings' environment should approximate initial stand development. The timing of this treatment should allow seedlings to begin growth on a relatively equal basis with other competing vegetation.

Year 0 - Plant 250 per acre. The species mix should be approximately 40 % Douglas-fir (recommend 2-0 bare root) and 60 % redwood (recommend Plug-1).

Year 3-Ground apply herbicides to control tanoak, ceanothus, and French broom so that seedling vigor is maintained. Tanoak sprouts should have enough leaf surface area so that a directed foliar spray would be expected to be effective. Eighty to 90 percent control of tanoak sprouts is desired.

Year 11-15 -Pre-commercial thin.

Concluding Remarks

The Berry Gulch 1993 Timber Sale has four other even-aged regeneration units proposed for clearcutting (Stands A, B, C, & E). The Structure Tree - even-aged Alternative Prescription was originally planned for these cut units, but the existing stand conditions made this type of prescription unworkable. These stands have an extensively developed understory of competing species (located in the lower 2/3's of each unit), and broadcast burning was determined necessary to ensure physical access to the site during planting operations. Potential structure trees would not likely survive the burn and the quantity and distribution of potential structure trees was found to be limited. The crowns of overstory trees indicated general poor tree vigor (especially in the Douglas-fir component). Stand "D" turned out to have the best stand conditions in which to implement this type of alternative prescription.

Structure Trees 'Marked Stand Statistics
1. Marked - 219
2. Net vol. - 130.7 MBF
3. Ave. net volume per acre - 6.9 MBF
4. Percent of total volume per acre - 13.4%

The State Forest is looking forward to reviewing the results of this prescription after it is implemented.

"SEMPERVIRENS" will be used to keep you informed on how the results match up with our growing expectations.

MISCELLANEOUS

Small Mammal Report

A contract research project dealing with small mammal populations on JDSF was completed last year. A summary of the report was published in an earlier newsletter. There is now a limited supply of the full report available upon request. The report is titled "Small Mammal Populations in Clearcut Areas of the Jackson Demonstration State Forest, Mendocino County, California." The report was submitted by Kimberly Marshall Fitts and Dr. Phillip Northern of Sonoma State University.

Timber Sales Activities On JDSF- 1992.

A summary for previous years can be found in Newsletters 40(Jan. 1991) and 44(Jan. 1992).

ACTIVE SALES

23 Gulch:
Awarded to Willits Financial for a high bid of $504.89/Mbf (thousand board feet) in October 1992. The majority of the 305 acres in the harvest area will be cut as a commercial thin (225 acres). Eleven acres will be clear cut, 22 acres cut as a seed tree step, and 47 ac under an alternative prescription. Cruised volume was 9,490 mbf.

Parlin Creek:
Operations on this sale commenced May, 1992. 5,600 Mbf has been cut through March 1993 with activity continuing through the winter period. Cruised volume was 11,120 mbf.

Hare Creek:
Georgia Pacific bought the timber for $484.10 mbf in November 1992. The cruised volume is 10,424 mbf. Single tree and group selection is the silvicultural treatment for the 700 acres in the sale area. Logging activities began in March 1993.

COMPLETED SALES:

Tunnel:
Harvesting was completed in August, 1992. Revenue for 5,492.54 mbf was $2,176,144.35. A shelterwood preparation step was implemented in the sale area.

Volcano:
A total of 7,734.61 mbf was removed for a total revenue of $1,710,122.00. The sale was completed in June, 1992.

Tramway:
The third and final sale in the Caspar Watershed Study Area was completed in January, 1992. Total volume harvested was 10,066.9 mbf for a revenue of $3,775,087.50.

Pacific Gas & Electric:
This sale was a right-of-way clearance and sold as a minor timber sale. 896.5 mbf was removed for a total revenue of $149,032.80.

PROSPECTIVE SALES:

Berry Gulch:
Silvicultural prescription is for an alternative method to convert the stand from even to uneven-aged. The sale area is 140 acres from which approximately 3.8 Mbf will be removed. Anticipated bid date will be in March, 1993.

Crib Wall:
The silvicultural prescription is for another transition from an even to a uneven-aged stand. There are approximately 280 acres involved for a projected harvest volume of 11.5 mbf.

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